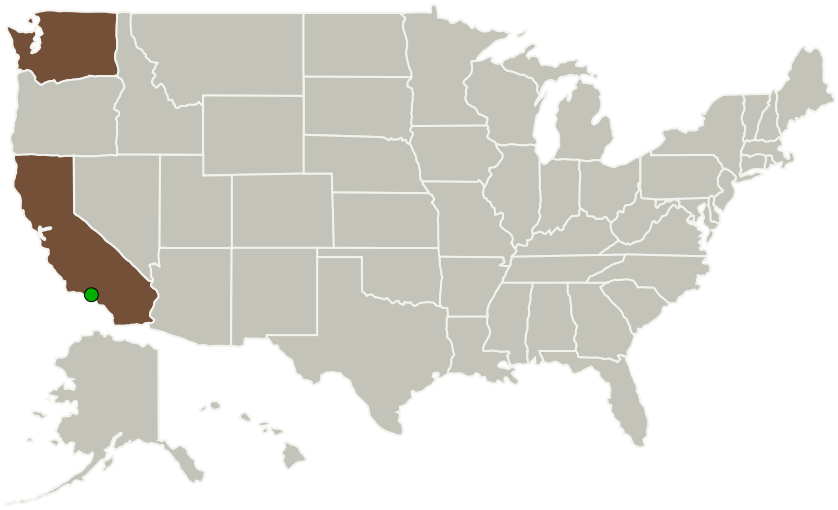
Adaptive Electric Propulsion for ISRU Missions, Phase I

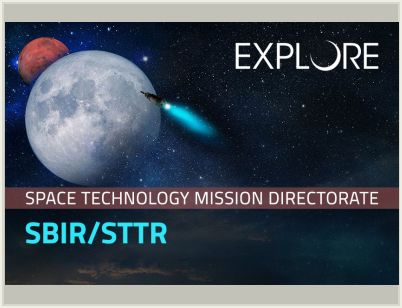
Completed Technology Project (2014 - 2014)

Project Introduction

The Electrodeless Lorentz Force Thruster (ELF-160A) has the ability to efficiently ionize and electromagnetically accelerate a variety of propellants over a broad range of specific impulses from 1,000-6,000 seconds. The ELF-160A thruster creates a high-density, magnetized plasmoid known as a Field Reversed Configuration (FRC) employing a Rotating Magnetic Field (RMF). The RMF driven azimuthal currents, coupled with the enhanced axial magnetic field gradient produced by the FRC inside the flux preserving conical thruster, produce a large axial JxBr force that accelerates the plasmoid to high velocity. The ELF-160A is completely electrodeless, the propellant is magnetically isolated from the thruster body, quasi-neutral, and there is zero contact between high temperature propellant and the thruster. Combined with a high ionization efficiency and rapid formation and ejection sequence, the ELF can operate on any gaseous propellant, and do so with a very long lifetime and with low thruster specific mass. The AFOSR-funded 200 kW ELF thruster was designed and testing using Nitrogen, pure Oxygen, and Xenon as its primary propellants and demonstrated no life limiting or erosion issues. The NASA developed 1kW class ElectroMagnetic Plasmoid Thruster (EMPT) demonstrated steady operation on a variety of propellant with over 100 Hrs of operation. The focus of this proposal is to take the results from the ELF and EMPT programs and develop a new 30 kW-class thruster that is capable of long duration operation on any gaseous propellant. Phase I will develop the new systems required to transition this technology to a 30 kW, thermally stable, high temperature thruster and PPU system.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
MSNW, LLC	Lead Organization	Industry	Redmond, Washington
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

Primary U.S. Work Locations	
California	Washington

Project Transitions

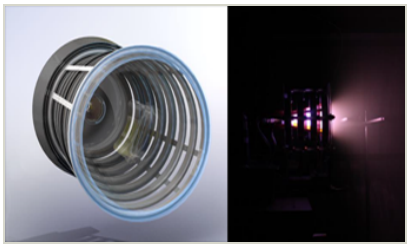
June 2014: Project Start

December 2014: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/137670)*

Images



Briefing Chart
Adaptive Electric Propulsion for ISRU Missions, Phase I
(https://techport.nasa.gov/image/133116)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
MSNW, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

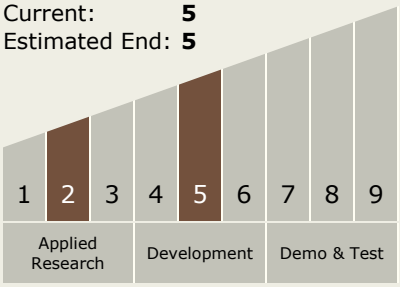
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
David Kirtley

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.2 Electric Space Propulsion
    - TX01.2.2 Electrostatic

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System